

WHAT IS CLAIMED IS:

1. A laser annealing method comprising:

irradiating a surface of an irradiation target formed over a substrate with a laser beam,
5 wherein the laser beam is directed obliquely to a major plane of the substrate, and
wherein a part of the laser beam transmits through the irradiation target.

2. A laser annealing method according to claim 1, wherein the laser beam becomes
uniform in energy distribution at or near an irradiation plane.

3. A laser annealing method according to claim 1, wherein the laser beam becomes
linear in shape at or near an irradiation plane.

4. A laser annealing method according to claim 1, wherein the laser beam becomes
15 uniform in energy distribution and linear in shape at or near an irradiation plane.

5. A laser annealing method according to claim 1, wherein the laser beam has a
wavelength of 350 nm or more.

20 6. A laser annealing method according to claim 1, wherein the laser beam has a
wavelength of 400 nm or more.

7. A laser annealing method according to claim 1, wherein the laser beam is the second
harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF
25 laser, a YAlO₃ laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer, and a glass laser.

8. A laser annealing method comprising:

irradiating a surface of an irradiation target formed over a substrate with a laser beam
at an incident angle θ ,

wherein a part of the laser beam transmits through the irradiation target,

wherein the incident angle θ satisfies

$$\theta \geq \arctan(w / (14 \times D)), (w = (w_1 + w_2) / 2),$$

where w_1 indicates a beam width of the laser beam irradiated onto the irradiation target, w_2
indicates a beam width of the part of the laser beam at the irradiation target after reflected by a
back surface of the substrate, and D indicates the thickness of the substrate.

9. A laser annealing method according to claim 8, wherein the laser beam becomes
uniform in energy distribution.

10. A laser annealing method according to claim 8, wherein the laser beam becomes
linear in shape.

11. A laser annealing method according to claim 8, wherein the laser beam becomes
uniform in energy distribution and linear in shape.

12. A laser annealing method according to claim 8, wherein the laser beam has a
wavelength of 350 nm or more.

13. A laser annealing method according to claim 8, wherein the laser beam has a
wavelength of 400 nm or more.

14. A laser annealing method according to claim 8, wherein the laser beam is the second harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF laser, a YAlO₃ laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer and a glass laser.

15. A laser annealing method comprising:
irradiating a surface of an irradiation target formed over a substrate with a laser beam at an incident angle θ ,

wherein a part of the laser beam transmits through the irradiation target,

wherein the incident angle θ satisfies

$$\theta \geq \arctan(w / (2 \times D)), (w = (w_1 + w_2) / 2),$$

where w_1 indicates a beam width of the laser beam irradiated onto the irradiation target, w_2 indicates a beam width of the part of the laser beam at the irradiation target after reflected by a back surface of the substrate. and D indicates the thickness of the substrate.

16. A laser annealing method according to claim 15, wherein the laser beam becomes uniform in energy distribution.

17. A laser annealing method according to claim 15, wherein the laser beam becomes linear in shape.

18. A laser annealing method according to claim 15, wherein the laser beam becomes uniform in energy distribution and linear in shape.

19. A laser annealing method according to claim 15, wherein the laser beam has a wavelength of 350 nm or more.

20. A laser annealing method according to claim 15, wherein the laser beam has a
5 wavelength of 400 nm or more.

21. A laser annealing method according to claim 15, wherein the laser beam is the second harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF laser, a YAlO₃ laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer and a glass
10 laser.

22. A laser annealing method comprising:
irradiating a surface of an irradiation target formed over a substrate with a laser beam in order to prevent an interfere with a reflected laser beam,
15 wherein the laser beam is directed obliquely to a major plane of the substrate, and wherein a part of the laser beam transmits through the semiconductor film.

23. A laser annealing method according to claim 22, wherein the laser beam irradiated onto the surface of the semiconductor film is not overlapped with the laser beam reflected by
20 the back surface of the substrate.

24. A laser annealing method according to claim 22, wherein the laser beam becomes uniform in energy distribution at or near an irradiation plane.

25. A laser annealing method according to claim 22, wherein the laser beam becomes linear in shape at or near an irradiation plane.

26. A laser annealing method according to claim 22, wherein the laser beam becomes
5 uniform in energy distribution and linear in shape at or near an irradiation plane.

27. A laser annealing method according to claim 22, wherein the laser beam has a wavelength of 350 nm or more.

10 28. A laser annealing method according to claim 22, wherein the laser beam has a wavelength of 400 nm or more.

29. A laser annealing method according to claim 22, wherein the laser beam is the second harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser,
15 a YLF laser, a YAlO₃ laser, a ruby laser, an alexandrite laser, a Ti:sapphire laser, and a glass laser.

30. A method for fabricating a semiconductor device comprising:
forming a semiconductor film over a substrate; and
20 irradiating a surface of the semiconductor film with a laser beam,
wherein the laser beam is directed obliquely to a major plane of the substrate, and
wherein a part of the laser beam transmits through the semiconductor film.

31. A method according to claim 30, wherein the laser beam becomes uniform in
25 energy distribution.

32. A method according to claim 30, wherein the laser beam becomes linear in shape.

33. A method according to claim 30, wherein the laser beam becomes uniform in
5 energy distribution and linear in shape.

34. A method according to claim 30, wherein the laser beam has a wavelength of 350
nm or more.

35. A method according to claims 30, wherein the laser beam has a wavelength of 400
10 nm or more.

36. A method according to claim 30, wherein the laser beam is the second harmonic of
one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF laser, a
15 YAlO₃ laser, a ruby laser, an alexandrite laser, a Ti:sapphire laser and a glass laser.

37. A method according to claims 30, wherein the semiconductor film comprises
silicon.

38. A method according to claims 30, wherein the semiconductor device is
20 incorporated into electronic equipment selected from the group consisting of a personal
computer, a video camera, a mobile computer, a goggle type display, a player, a digital camera,
a front type projector, a rear type projector, a mobile telephone, a mobile book, and a display.

39. A method for fabricating a semiconductor device comprising:
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forming a semiconductor film over a substrate; and

irradiating a surface of the semiconductor film with a laser beam at an incident angle θ ,

wherein a part of the laser beam transmits through the semiconductor film, and

wherein the incident angle θ satisfies

5 $\theta \geq \arctan(w / (14 \times D)), (w = (w_1 + w_2) / 2),$

where w_1 indicates a beam width of the laser beam irradiated on the irradiation target. w_2 indicates a beam width of the part of the laser beam at the irradiation target after reflected by a back surface of the substrate, and D indicates the thickness of the substrate.

10 40. A laser annealing method according to claim 39, wherein the laser beam becomes uniform in energy distribution.

41. A laser annealing method according to claim 39, wherein the laser beam becomes linear in shape.

15 42. A laser annealing method according to claim 39, wherein the laser beam becomes uniform in energy distribution and linear in shape.

20 43. A semiconductor device fabricating method according to claim 39, wherein the laser beam has a wavelength of 350 nm or more.

44. A semiconductor device fabricating method according to claims 39, wherein the laser beam has a wavelength of 400 nm or more.

45. A semiconductor device fabricating method according to claim 39, wherein the laser beam is the second harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF laser, a YAlO₃ laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer and a glass laser.

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46. A method according to claims 39, wherein the semiconductor film comprises silicon.

47. A method according to claims 39, wherein the semiconductor device is incorporated into electronic equipment selected from the group consisting of a personal computer, a video camera, a mobile computer, a goggle type display, a player, a digital camera, a front type projector, a rear type projector, a mobile telephone, a mobile book, and a display.

48. A method for fabricating a semiconductor device comprising:

forming a semiconductor film over a substrate; and

irradiating a surface of the semiconductor film with a laser beam at an incident angle θ .

wherein a part of the laser beam transmits through the semiconductor film,

wherein the incident angle θ satisfies

$$\theta \geq \arctan(w / (2 \times D)), (w = (w_1 + w_2) / 2),$$

where w_1 indicates a beam width of the laser beam irradiated on the semiconductor film. w_2 indicates a beam width of the part of the laser beam at the semiconductor film after reflected by a back surface of the substrate. and D indicates the thickness of the substrate.

49. A method according to claim 48, wherein the laser beam becomes uniform in energy distribution.

50. A method according to claim 48, wherein the laser beam becomes linear in shape.

51. A method according to claim 48, wherein the laser beam becomes uniform in
5 energy distribution and linear in shape.

52. A method according to claim 48, wherein the laser beam has a wavelength of 350
nm or more.

10 53. A method according to claims 48, wherein the laser beam has a wavelength of 400
nm or more.

54. A method according to claim 48, wherein the laser beam is the second harmonic of
one kind selected from the group consisting of a YAG laser, a YVO_4 laser, a YLF laser, a
15 YAIO_3 laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer and a glass laser.

55. A method according to claims 48, wherein the semiconductor film is a film
containing silicon.

20 56. A method according to claims 48, wherein the semiconductor device is
incorporated into electronic equipment selected from the group consisting of a personal
computer, a video camera, a mobile computer, a goggle type display, a player, a digital camera,
a front type projector, a rear type projector, a mobile telephone, a mobile book, and a display.

25 57. A method for fabricating a semiconductor device comprising:

forming a semiconductor film over a substrate; and
irradiating a surface of the semiconductor film with a laser beam in order to prevent an
interfere with a reflected laser beam,
wherein the laser beam is directed obliquely to a major plane of the substrate, and
5 wherein a part of the laser beam transmits through the semiconductor film.

58. A method according to claim 57, wherein the laser beam irradiated onto the surface
of the semiconductor film is not overlapped with the laser beam reflected by the back surface of
the substrate.

59. A method according to claim 57, wherein the laser beam becomes uniform in
energy distribution.

60. A method according to claim 57, wherein the laser beam becomes linear in shape.

61. A method according to claim 57, wherein the laser beam becomes uniform in
energy distribution and linear in shape.

62. A method according to claim 57, wherein the laser beam has a wavelength of 350
20 nm or more.

63. A method according to claims 57, wherein the laser beam has a wavelength of 400
nm or more.

64. A method according to claim 57, wherein the laser beam is the second harmonic of one kind selected from the group consisting of a YAG laser, a YVO₄ laser, a YLF laser, a YAlO₃ laser, a ruby laser, an alexandrite layer, a Ti:sapphire layer and a glass laser.

5 65. A method according to claims 57, wherein the semiconductor film is a film containing silicon.

66. A method according to claims 57, wherein the semiconductor device is incorporated into electronic equipment selected from the group consisting of a personal computer, a video camera, a mobile computer, a goggle type display, a player, a digital camera, a front type projector, a rear type projector, a mobile telephone, a mobile book, and a display.